MICRO CASE 4 --- Corynebacterium diptheriae (diptheria)

A nine year old girl presented with low-grade **fever, sore throat**, and mailaise for two days. These symptoms developed 10 days after arriving at a summer camp operated by a religious group. Recently, she was noted to have a dry cough and difficulty breathing. Her parents then brought her to the ER.

The family had **emigrated from Ukraine** one year before. The **child’s immunization status** could not be determined. She had been otherwise healthy.

* PHYSICAL EXAM:
  + **Respiratory stridor** present (stridor = A wheezing sound produced when inhaling air through the larynx and into the lungs. Inspiratory stridor occurs when the airway is obstructed by an object, by swelling of the tissues of the throat or upper airway, or by vocal cord dysfunction.)
  + **Exudative pharyngitis**
  + **Bilateral cervical adenopathy (“bull neck”**)
  + **Yellowish, leathery, thick membrane** extending to the uvula and soft palate
* DIAGNOSTIC WORK UP
  + Routine bacterial AND **SELECTIVE cultures** of throat swabs
  + Rapid tests (if necessary(:
    - Enzyme immunoassay (for strep Ag)
    - PCR testing of exotoxin gene
  + Monospot test
* DIFFERENTIAL:
  + Adenovirus, Anaerobes (oral flora), Corynebacterium diptheriae, EBV, H. influenzae type b, Influenzae type A, B, and C, Mycoplasma pneumoniae, Parainfluenza virus, streptococcus pyogenes
* Source = Corynebacterium diptheriae (diptheria)
* MICROBIOLOGICAL PROPERTIES
  + **Small, club shaped (“cornye”) Gram positive bacteria with metachromatic granules**
  + **Grow on a differential medium containing potassium tellurite (colonies look grayish black)**
  + **Most species are non-hemolytic and catalase positive**
  + A modified plate test based on **immunoprecipitation on agar can be performed to detect the toxigenic strain of C. diptheriae** (since there are various strains of cornybacterium)
* MANNER OF EXPOSURE
  + Person-to-person transmission via oral or respiratory droplets, close physical contact with skin lesions, and rarely by fomites
  + C. diptheriae is a human specific pathogen 🡪 immune individuals can serve as ASYMPTOMATIC carriers
* PATHOGENESIS
  + C. diptheriae colonizes the pharynx 🡪 PMNs recruited 🡪 **Toxin production occurs when C. diptheriae is infected by a virus (phage) carrying the tox gene**. 🡪 Toxin is excreted locally and also goes into systemic circulation 🡪 “B” fragment of the AB toxin binds specifically to cell-surface receptor (a membrane bound form of the heparin-binding EGF-like growth factor). 🡪 The **“A” fragment inhibits protein synthesis intracellularly by ADP-ribosylation of elongation factor 2**. 🡪 Protein synthesis is blocked in the target cells locally in the posterior pharynx and in the end organs, resulting in cell death and tissue necrosis. 🡪 This dense necrotic coagulum of organisms, epithelial cells, fibrin, leukocytes, and erythrocyes forms a gray-brown adherent pseudomembrane.
* Treatment
  + Equine antitoxin must be given within 3 days
  + Antibiotics: penicillin ad erythromycin (can reduce severity but has no effect on outcome when effects of diptheriae toxin are present)
  + **Untreated respiratory diptheriae may develop complications such as: (1) airway obstruction due to pseudomembrane (2) paralysis of the palate and hypopharynx due to effect of toxin (3) myocarditis with arrhthymias and circulatory collapse and recurrent laryngeal nerve palsy due to circulatory toxin**
* Prevention
  + DTaP vaccine
  + **Immunity wanes with time, so adults should receive booster vaccines every 10 years**
  + **Immunization does not prevent an asymptomatic carrier state**
  + **Clinical disease does not always produce protective immunity**